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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/680,260	10/08/2003	David William Abraham	YOR920030013US1	5657
48150	7590	04/10/2006	EXAMINER	
MCGINN INTELLECTUAL PROPERTY LAW GROUP, PLLC			MAI, ANH D	
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SUITE 200			PAPER NUMBER	
VIENNA, VA 22182-3817			2814	

DATE MAILED: 04/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/680,260

Applicant(s)

ABRAHAM ET AL.

Examiner

Anh D. Mai

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2006 (pre-appeal conference).
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### *Status of the Claims*

1. As of February 28, 2006, claims 1-26 are pending.

### *Declaration Under 37 C.F.R. § 1.131*

2. The Declaration filed on September 15, 2005 under 37 CFR 1.131 has been considered by a Pre-Appeal Conference panel. The Declaration was determined to be valid to overcome the Kamata '224, Grynkewich '351 and Klemmer '349 references. The rejections based upon those references are therefore withdrawn.

### *Claim Objections*

3. Claims 3, 6, 7 and 22 are objected to because of the following informalities: the term used in claim 1 is "transforming" however, the above claims recite: "**converting**", thus, inconsistent with claim 1. Appropriate correction is required.
4. Claim 13 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim 13 recites: further comprising producing a magnetic device.

Since the “producing a magnetic device” of claim 13 does not include any elements that narrows the device already formed by claim 1, claim 13, thus, fails to further limit claim 1.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 25-26 are rejected under 35 U.S.C. 112, first paragraph, because the best mode contemplated by the inventor has not been disclosed. Evidence of concealment of the best mode is based upon Figs. 1-4 and the instant disclosure.

6. Claims 25 and 26 are further rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

At best, the disclosure shows a patterned magnetic layer 220 over a substrate 210 and contacting electrode 270 via a conductive material.

However, the particular disclosed device does not seem to be an MTJ device as claimed. Therefore, claims 25 and 26 lack both best mode and enablement requirements.

Accordingly, any device which comprises a magnetic layer is considered to be an MTJ.

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The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 13, 22 and 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 13, recites: “producing a magnetic device”.

What is the magnetic device ?

Is the device produced by claim 1 not a magnetic device ?

What is the difference between the magnetic device produced by claim 1 and that of claim 13 ?

Claim 13 recites “further comprising: producing a magnetic device” but without providing any other process steps that already recited in claim 1, thus, claim 13 is indefinite.

Claim 22, lines 3-4, recites: after said converting, selectively etching said insulating hard mask to pattern said insulating hard mask.

However, according to Figs. 2A-C, after converting, the insulating hard mask 230 is removed. Therefore, the term “pattern” is indefinite.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-3, 13 and 16 and are rejected under 35 U.S.C. 102(b) as being anticipated by Baglin et al. (U.S. Patent No. 6,331,364) of record.

With respect to claim 1, Baglin teaches a method of patterning a magnetic thin film as claimed including:

transforming a portion of the magnetic thin film (30) to be non-magnetic and electrically insulating (44) using a chemical transformation. (See Fig. 2).

With respect to claim 2, the method of Baglin further comprises providing a mask (60) over the portion (46) of the magnetic thin film (30) to be preserved using photolithography.

With respect to claim 3, the method of Baglin further comprises converting the portion (44) of the magnetic thin film (30) by a reactive plasma.

With respect to claim 13, the method of Baglin producing a magnetic device.

With respect to claim 16, the reactive plasma of Baglin includes argon.

9. Claims 1-3, 11, 13, 14, 20, 21, 25 and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al. (U.S. Patent No. 6,165,803).

With respect to claim 1, Chen teaches a method of patterning a magnetic thin film as claimed including:

transforming a portion of the magnetic thin film (42) to be non-magnetic and electrically insulating (42b) using a chemical transformation. (See Figs. 6-7).

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With respect to claim 2, the method of Chen further comprises providing a mask (52) over the portion (42a) of the magnetic thin film (30) to be preserved using photolithography.

With respect to claim 3, the method of Chen further comprises converting the portion (42b) of the magnetic thin film (42) by a reactive plasma.

With respect to claim 11, the mask of Chen comprises photoresist

With respect to claim 13, the method of Chen produces a magnetic device.

With respect to claim 14, the chemical transformation of Chen is performed at room temperature.

With respect to claim 20, the method of Chen further includes:

forming an insulating layer (72) over the converted portion (42b) of the magnetic film (42) and the mask (52); and

etching the insulating film (72) and the mask (52) to planarize an upper level of the mask (52) and the insulating layer (72). (See Fig. 12).

With respect to claim 21, the method of Chen further includes: selectively etching the mask (52); and forming a conductive material (70) over the insulating layer (72) and the area where the mask (52) was selectively etched.

With respect to claim 25, the magnetic thin film (42) of Chen includes a magnetic tunnel junction (MTJ), and after the converting the portion (42b), edges of the magnetic tunnel junction have no exposure to oxygen.

With respect to claim 26, the edge smoothness of the MTJ of Chen is determined by a line edge roughness of the mask (52).

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10. Claims 1-4, 7-11, 13, 19, 22 and 24-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Fontana, Jr. et al. (U.S. Patent No. 6,168,845).

With respect to claim 1, Fontana teaches method of patterning a magnetic thin film as claimed including:

transforming a portion of the magnetic thin film (119) to be non-magnetic and electrically insulating (130) using a chemical transformation. (See Figs. 3a-g).

With respect to claim 2, the method of Fontana further includes: providing a mask (123/126) over the portion of the magnetic thin film (119) to be preserved using photolithography.

With respect to claim 3, the method of Fontana further includes: converting the portion (130) of the magnetic thin film (119) by a reactive plasma.

With respect to claim 4, using the chemical transformation of Fontana includes using a fluorine-based reactive plasma.

With respect to claim 7, the portion of the magnetic thin film (119) of Fontana comprises of alloys of nickel, iron, and cobalt, and the converting comprising converting the alloys of nickel, iron, and cobalt, to a fluorine-containing film.

With respect to claim 8, the fluorine-containing film (119) of Fontana is non-ferromagnetic.

With respect to claim 9, the fluorine-containing film (119) of Fontana is non-magnetic.

With respect to claim 10, the fluorine-containing film (119) of Fontana is electrically insulating.



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With respect to claim 11, the mask of Fontana comprises a photoresist (123).

With respect to claim 13, the method of Fontana further includes: producing a magnetic device.

With respect to claim 19, the pressure of Fontana is Kamata is selectively employed for the plasma sputtering such that the magnetic thin film material (119) is substantially free of erosion.

With respect to claim 22, the mask (121/123) of Fontana comprises an insulating hard mask (123), the method of Fontana further includes: after the converting, selectively etching the insulating hard mask (126) to pattern the insulating hard mask.

With respect to claim 24, the reactive plasma of Fontana includes O<sub>2</sub> and a fluorine-containing gas.

With respect to claim 25, the magnetic thin film (119) of Fontana includes a magnetic tunnel junction (MTJ), and after the converting the portion (130), the edges of the magnetic tunnel junction (119) have no exposure to oxygen. (see Fig. 3g).

With respect to claim 26, the edge smoothness of the MTJ (119) of Fontana is determined by a line edge roughness of the mask (121/123).

11. Claims 1-11, 13-15, 17, 19 and 22-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Kamata et al. (U.S. Pub. No. 2002/0142192).

With respect to claim 1, Kamata teaches method of patterning a magnetic thin film as claimed including:

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transforming a portion of the magnetic thin film (20) to be non-magnetic and electrically insulating (40) using a chemical transformation. (See Figs. 3A-B).

With respect to claim 2, the method of Kamata further includes: providing a mask (30) over the portion of the magnetic thin film (20) to be preserved using photolithography.

With respect to claim 3, the method of Kamata further includes: converting the portion of the magnetic thin film (20) by a reactive plasma.

With respect to claim 4, using the chemical transformation of Kamata includes using a fluorine-based reactive plasma.

With respect to claim 5, the fluorine-based reactive plasma of Kamata  $\text{CF}_4$ ,  $\text{SF}_6$ ,  $\text{CHF}_3$ .

With respect to claim 6, the pressure used in the converting of Kamata is within a range of about 10 mT to about 30 mT.

With respect to claim 7, the portion of the magnetic thin film (20) of Kamata comprises of alloys of nickel, iron, and cobalt, and the converting comprising converting the alloys of nickel, iron, and cobalt, to a fluorine-containing film.

With respect to claim 8, the fluorine-containing film (40) is non-ferromagnetic.

With respect to claim 9, the fluorine-containing film (40) of Kamata is non-magnetic.

With respect to claim 10, the fluorine-containing film (40) of Kamata is electrically insulating.

With respect to claim 11, the mask (30) of Kamata comprises a photoresist.

With respect to claim 13, the method of Kamata further includes: producing a magnetic device.

With respect to claim 14, the using chemical transformation of Kamata can be performed at room temperature.

With respect to claim 15, the reactive plasma of Kamata includes a fluorocarbon.

With respect to claim 17, the reactive plasma of Kamata includes sulfur hexafluoride.

With respect to claim 19, the pressure of Kamata is selectively employed for the plasma sputtering such that the magnetic thin film material (20) is substantially free of erosion.

With respect to claim 22, the mask of Kamata comprises an insulating hard mask (360), the method of Kamata further includes: after the converting, selectively etching the insulating hard mask (360) to pattern the insulating hard mask.

With respect to claim 23, the method of Kamata further includes: forming a conductive material (380) over the area where the insulating hard mask (360) was etched.

With respect to claim 24, the reactive plasma of Kamata includes a fluorine-containing gas.

With respect to claim 25, the magnetic thin film (20) of Kamata includes a magnetic tunnel junction (MTJ), and wherein after the converting portion, the edges of the magnetic tunnel junction have no exposure to oxygen. (see Figs 13).

With respect to claim 26, the edge smoothness of the MTJ of Kamata is inherently determined by a line edge roughness of the mask (360).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata '192 as applied to claim 2 above, and further in view of Ning et al. (U.S. Pub. No. 2002/0098676).

With respect to claim 12, Kamata teaches providing a mask over a portion of the magnetic thin film for patterning.

Thus, Kamata is shown to teach all the features of the claim with the exception of utilizing a metal hard mask.

However, Ning teaches utilizing photolithography to provide a mask including TaN, TiN (244) for patterning.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to provide a hard mask of Kamata including a TiN and TaN as taught by Ning for patterning over the portion of the magnetic thin film.

13. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata as applied to claim 3 above, and further in view of Baglin '364.

Kamata teaches converting a portion of a magnetic thin film by a reactive plasma.

Thus, Kamata is shown to teach all the features of the claim with the exception of using argon for the reactive plasma.

However, Baglin teaches other ion species that may be used to converting a magnetic thin film including argon. (See col. 10, lines 9-13).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to convert a portion of the magnetic thin film of Kamata utilizing argon plasma as taught by Baglin to achieve the desired chemical conversion.

14. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata '192.

Kamata teaches converting a portion of the magnetic thin film (20) into non-magnetic insulating (40).

Thus, Kamata is shown to teach all the features of the claim with the exception of explicitly to include bromide.

However, Kamata teaches the reactive gas containing halide. It is well known that bromide is a member of halide gas.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to converting a portion of the magnetic thin film of Kamata utilizing bromide, since bromide as well as iodide, fluoride or chloride are member of reactive gas known as halide.

15. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata '192 as applied to claim 3 above, and further in view of Chen '803

With respect to claim 20, Kamata teaches converting a portion of magnetic thin film (20) by reactive plasma.

Thus, Kamata is shown to teach all the features of the claim with the exception of further process step.

However, Chen teaches process steps following the conversion including:

forming an insulating layer (72) over the converted portion (42b) of the magnetic thin film (42) and the mask (52); and

etching the insulating layer (72) and the mask (52) to planarize the upper level of the mask (52) and the insulating layer (72). (See Fig. 12).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to further process the converted magnetic thin film of Kamata utilizing the further process step as taught by Chen to form the MTJ device.

With respect to claim 21, the method of Chen, further includes:

selectively etching the mask (52); and forming a conductive material (70) over the insulating layer (72) and the area where the mask (52) was selectively etched. (See Fig. 13).

### ***Response to Arguments***

16. Applicant's arguments with respect to pending claims have been considered but are moot in view of the new ground(s) of rejection.

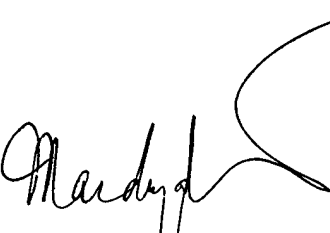
### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 8:00AM-5:00PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



**ANH D. MAI**  
**PRIMARY EXAMINER**